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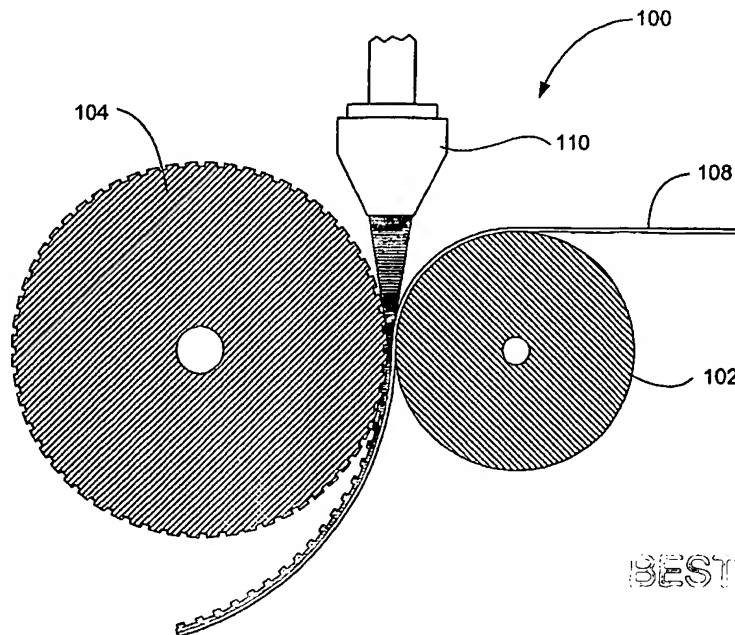
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(54) Title: LIQUID-TRAPPING BAG AND METHOD OF MAKING IT



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(57) Abstract: A bag for use in vacuum packaging comprises a first and second overlapping panels. A plurality of channels having a plurality of baffles is formed on one or more of the panels for evacuating air or other gases from inside the bag using suction, while preventing liquids from being drawn inside it. In one embodiment, the forming of a bag involves between cooling and laminating rolls includes feeding a gas-impermeable material to a nip between the rolls. Resin is extruded to the nip so that it fills a plurality of cavities of the cooling roll, forming an inner layer that adheres to the gas-impermeable material. The resultant sheet is folded to form the first and second panels and they are sealed to form an envelope.

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LIQUID-TRAPPING BAG AND METHOD OF MAKING IT.

**CLAIM OF PRIORITY**

[0001] This application claims priority from U.S. Provisional Patent Application No. 60/452,168, entitled "LIQUID-TRAPPING BAG FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01177US0); U.S. Provisional Patent Application No. 60/452,138, entitled "METHOD FOR MANUFACTURING LIQUID-TRAPPING BAG FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01177US1); U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_ entitled "LIQUID-TRAPPING BAG FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01177US2); and U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_ entitled "METHOD FOR MANUFACTURING LIQUID-TRAPPING BAG FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01177US3).

**CROSS-REFERENCE TO RELATED PATENT APPLICATIONS**

[0002] This application incorporates by reference all of the following co-pending applications:

[0003] U.S. Provisional Patent Application No. 60/452,172, entitled "SEALABLE BAG HAVING AN INTEGRATED TRAY FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01178US0);

[0004] U.S. Provisional Patent Application No. 60/452,171, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED TRAY FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01178US1);

[0005] U.S. Provisional Patent Application No. 60/451,954, entitled "SEALABLE BAG HAVING AN INDICIA FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01179US0);

[0006] U.S. Provisional Patent Application No. 60/451,948, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INDICIA FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01179US1);

[0007] U.S. Provisional Patent Application No. 60/452,142, entitled "SEALABLE BAG HAVING AN INTEGRATED ZIPPER FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01180US0);

**[0008]** U.S. Provisional Patent Application No. 60/452,021, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED ZIPPER FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01180US1);

5 **[0009]** U.S. Provisional Patent Application No. 60/451,955, entitled "SEALABLE BAG HAVING AN INTEGRATED VALVE STRUCTURE FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01181US0);

**[0010]** U.S. Provisional Patent Application No. 60/451,956, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED VALVE STRUCTURE FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01181US1);

**[0011]** U.S. Provisional Patent Application No. 60/452,157, entitled "SEALABLE BAG HAVING AN INTEGRATED TIMER/SENSOR FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01182US0);

15 **[0012]** U.S. Provisional Patent Application No. 60/452,139, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED TIMER/SENSOR FOR USE IN VACUUM PACKAGING," by Henry Wu, et al., filed March 5, 2003 (Attorney Docket No. TILA-01182US1);

**[0013]** U.S. Patent Application No. 10/169,485, entitled "METHOD FOR PREPARING AIR CHANNEL EQUIPPED FILM FOR USE IN VACUUM PACKAGE," filed June 26, 2002;

**[0014]** U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_, entitled "SEALABLE BAG HAVING AN INTEGRATED TRAY FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01178US2);

25 **[0015]** U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED TRAY FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01178US3);

**[0016]** U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_, entitled "SEALABLE BAG HAVING AN INDICIA FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01179US2);

**[0017]** U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_, entitled "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INDICIA FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01179US3);

35 **[0018]** U.S. Patent Application No. 10/\_\_\_\_,\_\_\_\_, entitled, "SEALABLE BAG HAVING

AN INTEGRATED ZIPPER FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01180US2);

[0019] U.S. Patent Application No. 10/\_\_\_\_, entitled, "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED ZIPPER FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01180US3);

[0020] U.S. Patent Application No. 10/\_\_\_\_, entitled, "SEALABLE BAG HAVING AN INTEGRATED VALVE STRUCTURE FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01181US2);

[0021] U.S. Patent Application No. 10/\_\_\_\_, entitled, "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED VALVE STRUCTURE FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01181US3);

[0022] U.S. Patent Application No. 10/\_\_\_\_, entitled, "SEALABLE BAG HAVING AN INTEGRATED TIMER/SENSOR FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01182US2); and

[0023] U.S. Patent Application No. 10/\_\_\_\_, entitled, "METHOD FOR MANUFACTURING A SEALABLE BAG HAVING AN INTEGRATED TIMER/SENSOR FOR USE IN VACUUM PACKAGING," by Hongyu Wu, et al., filed March 4, 2004 (Attorney Docket No. TILA-01182US3).

#### FIELD OF THE INVENTION

[0024] The present invention relates to bags for use in vacuum packaging and methods and devices for manufacturing bags for use in vacuum packaging.

#### BACKGROUND

[0025] Methods and devices for preserving perishable foods such as fish and meats, processed foods, prepared meals, and left-overs, and non-perishable items are widely known, and widely varied. Foods are perishable because organisms such as bacteria, fungus and mold grow over time after a food container is opened and the food is left exposed to the atmosphere. Most methods and devices preserve food by protecting food from organism-filled air. A common method and device includes placing food into a gas-impermeable plastic bag,

evacuating the air from the bag using suction from a vacuum pump or other suction source, and tightly sealing the bag.

**[0026]** A bag for use in vacuum packaging can consist of a first panel and second panel, each panel consisting of a single layer of heat-sealable, plastic-based film (for example, polyethylene). The panels are sealed together along a substantial portion of the periphery of the panels by heat-sealing techniques so as to form an envelope. Perishable products, such as spoilable food, or other products are packed into the envelope via the unsealed portion through which air is subsequently evacuated. After perishable products are packed into the bag and air is evacuated from the inside of the bag, the unsealed portion is heated and pressed such that the panels adhere to each other, sealing the bag.

**[0027]** U.S. Pat. No. 2,778,173, incorporated herein by reference, discloses a method for improving the evacuation of air from the bag by forming channels in at least one of the panels with the aid of embossing techniques. Air escapes from the bag along the channels during evacuation. The embossing forms a pattern of protuberances on at least one of the panels. The protuberances can be discrete pyramids, hemispheres, etc., and are formed by pressing a panel using heated female and male dies. The first panel is overlaid on the second panel such that the protuberances from one panel face the opposite panel. The contacting peripheral edges of the panels are sealed to each other to form an envelope having an inlet at an unsealed portion of the periphery. The perishable or other products are packed into the envelope through the inlet, and the inlet is sealed. Thereafter, an opening is pierced in a part of the panel material that communicates with the channels, air is removed from the interior of the envelope through the channels and opening, and the opening is sealed. This type of bag requires two additional sealing steps after the perishable or other product is packed into the envelope. One further problem is that embossing creates impressions on the plastic such that indentations are formed on the opposite side of the panel.

**[0028]** To avoid additional sealing steps, a vacuum bag is formed having a first

panel and a second panel consisting of laminated films. Each panel comprises a heat-sealable inner layer, a gas-impermeable outer layer, and optionally, one or more intermediate layers. Such a bag is described in U.S. Pat. No. Re. 34,929, incorporated herein by reference. At least one film from at least one panel is embossed using an embossing mold to form protuberances and channels defined by the space between protuberances, so that air is readily evacuated from the vacuum bag.

[0029] U.S. Pat. No. 5,554,423, incorporated herein by reference, discloses still another bag usable in vacuum packaging. The bag consists of a first and second panel, each panel consisting of a gas-impermeable outer layer and a heat-sealable inner layer. A plurality of heat-sealable strand elements are heat bonded at regular intervals to the inner layer of either the first panel or the second panel. The spaces between strand elements act as channels for the evacuation of air. The strand elements are extruded from an extrusion head and heat bonded to the heat-sealable layer by use of pressure rolls. Separate equipment is required for producing strand elements, and a procedure of heat bonding a plurality of strand elements at regular intervals to the heat-sealable inner layer is complicated. Also, various shapes of pattern are hard to form using this process.

### BRIEF DESCRIPTION OF THE FIGURES

[0030] Further details of embodiments of the present invention are explained with the help of the attached drawings in which:

[0031] **FIG. 1A** is a perspective view of a method for manufacturing a vacuum bag in accordance with one embodiment of the present invention;

[0032] **FIG. 1B** is a side view of the method shown in **FIG. 1A** illustrating the embossing method used in an embodiment of the present invention;

[0033] **FIG. 1C** is a close-up view of a portion of **FIG. 1B**;

[0034] **FIG. 2A** is a top view of a partial portion of a first panel overlapping a partial portion of a second panel in accordance with one embodiment of the present invention;

[0035] **FIG. 2B** is a cross-section view through line 2B-2B of **FIG. 2A**;

[0036] **FIG. 3A-3E** are plan views of exemplary patterns on a panel in accordance with embodiments of the present invention, manufactured by the process shown in **FIG. 1**; and

[0037] **FIG. 4** is a perspective view of a vacuum bag in accordance with one embodiment of the present invention.

### DETAILED DESCRIPTION

[0038] The detailed embodiments of the present invention are disclosed herein. It should be understood, however, that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, the details disclosed herein are not to be interpreted as limiting, but merely as the basis for the claims and as a basis for teaching one skilled in the art how to make and/or use the invention.

[0039] **FIGs. 1A-1C** illustrate one embodiment of a method for manufacturing a vacuum bag in accordance with the present invention. The vacuum bag comprises a first panel and a second panel, where each panel comprises a gas-impermeable base layer 108



and a heat-sealable inner layer 106 with at least one panel having liquid flow obstructing protuberances and/or channels. A laminating roll 102 and a cooling roll 104 are arranged so that melt-extruded resin can be introduced between the rolls and cooled to form the heat-sealable inner layer 106 and to laminate the formed inner layer 106 to the gas-impermeable base layer 108. As illustrated in FIG. 1C, a gap between the laminating roll 102 and the cooling roll 104 can be controlled according to specifications (for example, thickness) of a panel for use in vacuum packaging. The temperature of the cooling roll 104 is maintained in a range such that the melt-extruded resin can be sufficiently cooled to form a desired pattern. For example, a temperature range of about -15°C to about -10°C can be sufficient to properly form the desired pattern. The temperature range of the cooling roll 104 can vary according to the composition of the resin, the composition of the gas-impermeable base layer 108, environmental conditions, etc. and can require calibration. Also, the cooling roll 104 can be sized to have a larger diameter than the laminating roll 102, thereby bringing the melt-extruded resin into contact with more cooled surface area. For example, the diameter of the cooling roll 104 can be about one-and-a-half to about three times as large (or more) as that of the laminating roll 102.

**[0040]** The heat-sealable inner layer 106 typically comprises a thermoplastic resin. For example, the resin can be comprised of polyethylene (PE) suitable for preserving foods and harmless to a human body. A vacuum bag can be manufactured by overlapping two panels such that the heat-sealable inner layers 106 of the two panels are brought into contact and heat is applied to a portion of the periphery of the panels to form an envelope. The thermoplastic resin can be chosen so that the two panels strongly bond to each other when sufficient heat is applied.

**[0041]** The gas-impermeable base layer 108 is fed to the gap between the cooling roll 104 and the laminating roll 102 by a feeding means (not shown). The gas-impermeable base layer can be comprised of polyester, polyamide, ethylene vinyl alcohol (EVOH), nylon,

or other material having similar properties, that is capable of being heated and capable of being used in this manufacturing process. The gas-impermeable base layer **108** can consist of one layer, or two or more layers. When employing a multilayer-structured base layer, it should be understood that a total thickness thereof is also adjusted within the allowable range for the total gas-impermeable base layer **108**.

**[0042]** An extruder **110** is positioned in such a way that the melt-extruded resin is layered on the gas-impermeable base layer **108** by feeding the melt-extruded resin to a nip between the cooling roll **104** and the gas-impermeable base layer **108**. The resin is fed through a nozzle **112** of the extruder **110**. The temperature of the melt-extruded resin is dependent on the type of resin used, and can typically range from about 200°C to about 250°C. The amount of resin extruded into the laminating unit **100** is dependent on the desired thickness of the heat-sealable inner layer **106**.

**[0043]** A pattern fabricated on the circumferential surface of the cooling roll **104** in accordance with one embodiment of the present invention can include cavities (and/or protuberances) defining a plurality of discrete channels having a baffled structure. The resin extruded from the nozzle **112** is pressed between the cooling roll **104** and the gas-impermeable base layer **108** and flows into the cavities of the cooling roll **104**. The resin quickly cools and solidifies in the desired pattern while adhering to the gas-impermeable base layer **108**, thereby forming the heat-sealable inner layer **106** of the panel. The heat-sealable inner layer **106** can be formed while the resin is sufficiently heated to allow the resin to flow, thereby molding the resin, unlike other methods adopting a post-embossing treatment where the heat-sealable inner layer is formed by a die or embossed between male and female components.

**[0044]** The thickness of each protuberance formed on the heat-sealable inner layer **106** of a panel can be determined by the depth of the cavities of the cooling roll **104**, and the width of the channel can be determined by the interval between the cavities. Thus, the shape,

width, and thickness of the chambers for the evacuation of air and/or other gases can be controlled by changing the specifications for the cavities of the cooling roll **104**. **FIGS. 2A and 2B** illustrate a cross-section (along line **2B-2B**) of two panels in accordance with one embodiment of the present invention (the thickness of the panels are exaggerated relative to the width of the channel walls and baffles). The heat-sealable inner layer **106** can range from preferably 0.5-6.0 mils in thickness at the channels **224**, and preferably 1.0-12.0 mils in thickness at the protuberances **226, 228**, while the gas-impermeable base layer **108** can range from about preferably 0.5-1.0 mils in thickness. The dimensions of the inner layer and the base layer are set forth to illustrate, but are not to be construed to limit the dimensions of the inner layer and the base layer.

**[0045]** **FIG. 3A** is a perspective view of a pattern **320** formed on a panel by the cooling roll **104** for use in a vacuum bag, in which the heat-sealable inner layer **106** is molded in such a way that protuberances form a plurality of channels **224** having channel walls **226** and baffles **228**. The baffles **228** can be arranged in a herringbone pattern at angles such that air and/or other gases **340** (shown schematically) can be drawn around the baffles **228** by suction and evacuated from the vacuum bag, while heavier liquid particles **342** can be trapped between the channel walls **226** and the baffles **228**. Angles formed by the intersection of baffles **228** and channel walls **226**, and gaps between adjacent baffles **228** can be defined when producing the cooling roll **104** to suit the liquid intended to be trapped. Different arrangements of the baffles **228** relative to the chamber walls **226**, and relative to other baffles **228** can be multi-folded (used to define liquid-trapping vessels), and can be optimized to improve evacuation of the air and/or other gases **340**, while effectively preventing liquids **342** from being drawn out of the vacuum bag. For example, as shown in **FIG. 3A** the baffles **228** can be arranged such that the approach angle for passing through the channel opening between the baffles **228** is small and that vessels formed by the baffles **228** are relatively deep, thereby retarding liquid **342** by deflecting liquid **342** into the vessels and trapping a

significant amount of liquid 342.

**[0046]** As indicated in FIG. 3A, one of ordinary skill in the art can appreciate the multitude of different baffle arrangements for retarding the evacuation of liquid 342 relative to the evacuation of air and/or other gases 340. As shown in FIG. 3B, in other embodiments a pattern 320 fabricated on the circumferential surface of the cooling roll 104, and thereafter the panel, can mold protuberances forming a plurality of channels 224 defined by "V"-shaped baffles 228, eliminating the need for molding channel walls. In still other embodiments, the channel walls 226 can extend substantially the length of the panel with only a portion of the length of the channels near an evacuation opening having baffles 228.

**[0047]** As shown in FIG. 3C, in other embodiments a pattern 320 fabricated on the circumferential surface of the cooling roll 104, and thereafter the panel, can mold protuberances forming a plurality of channels 224 having channel walls 226 and baffles 228, wherein each baffle 228 extends across a substantial portion of the width of the channel 224, thereby defining a path between a baffle 228 and the channel wall 226 for the air and/or other gases 340 to be drawn out. Baffles 228 can alternatively be parabolic or rounded, as shown in FIG. 3D, to form paths for collecting liquid particles 342.

**[0048]** FIG. 3E illustrates another embodiment of a pattern 320 fabricated on the circumferential surface of the cooling roll 104, and thereafter the panel, that can include parabolically-shaped or "U"-shaped baffles 228 arranged like fish-scales either along the length of the panel, or a portion of the panel to capture liquid particles 342. The U-shaped baffles 228 can also include openings in the troughs of the U-shaped baffles 228 small enough to improve the flow of air and/or other gases 340 while retarding an amount of liquid particles 342. In other embodiments, baffles 228 can be more or less parabolic. One of ordinary skill in the art can appreciate the multitude of different baffle shapes for retarding the evacuation of liquid relative to the evacuation of air or other gases.

**[0049]** It is understood that the trapping of liquid in baffles or vessels formed in the

bag is advantageous as this structure retards and prevents liquids from being drawn into the vacuum pump or suction device. The vacuum sealing tool such as disclosed in U.S. Pat. No. 4,941,310, which is incorporated herein by reference.

[0050] FIG. 4 illustrates a bag for use in vacuum packaging in accordance with one embodiment of the present invention. The vacuum bag 450 comprises a first panel 452 and a second panel 454 overlapping each other. Channels 224 are formed on at least one of the panels 452,454 in accordance with an embodiment described above. The heat-sealable inner layer 106 and the gas impermeable base layer 108 of the first and second panels 452,454 are typically made of the same material respectively, but can alternatively be made of different materials that exhibit heat-sealability and gas-impermeability respectively. As described above, the resin-coated layer 106 is used as an inner layer and the gas-impermeable base layer 108 is used as an outer layer. The lower, left, and right edges of the first and the second panel 452,454 are bonded to each other by heating, so as to form an envelope for receiving a perishable or other product to be vacuum packaged. Once a perishable or other product is placed in the vacuum bag 450, air and/or other gases can be evacuated from the bag 450, for example by a vacuum sealing machine as described in the above referenced U.S. Pat. No. 4,941,310, which is incorporated herein by reference. Once the air and/or other gases are evacuated to the satisfaction of the user, the inlet can be sealed by applying heat, thereby fusing the heat-sealable inner layers 106 and bonding them together where contact is made.

[0051] The foregoing description of preferred embodiments of the present invention has been provided for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. It is to be understood that many modifications and variations are apparent to the practitioner skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand

the invention for various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

**CLAIMS**

1. A bag adapted to receive an article, comprising:
  - a first panel including a plurality of protuberances;
  - a second panel;
  - the first panel and the second panel secured together to form the bag.
  
2. A bag adapted to receive an article, comprising:
  - a first panel including:
    - a first outer layer; and
    - a first inner layer connected with the first outer layer, the first inner layer including a plurality of protuberances; and
  - a second panel connected with the first panel such that the first panel and the second panel form an envelope defining an inlet, the second panel having:
    - a second outer layer; and
    - a second inner layer connected with the second outer layer;
  - wherein when the first inner layer contacts the second inner layer the plurality of protuberances obstruct liquid flow through the inlet.
  
3. The bag of claim 2, wherein the first outer layer and the second outer layer comprise a gas-impermeable material.
  
4. The bag of claim 3, wherein the gas-impermeable material is one of polyester, polyamide, ethylene vinyl alcohol, and nylon.
  
5. The bag of claim 2, wherein the first inner layer and the second inner layer comprise a thermoplastic resin.

6. The bag of claim 5, wherein the thermoplastic resin is polyethylene.

7. The bag of claim 2, wherein the plurality of protuberances define a plurality of channels.

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8. The bag of claim 7, wherein the plurality of channels includes a plurality of baffles.

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9. The bag of claim 8, wherein the plurality of baffles are arranged in a herringbone pattern.

10. The bag of claim 8, wherein the plurality of baffles form a plurality of pockets for trapping liquid particles.

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11. The bag of claim 2, wherein the plurality of protuberances define a plurality of baffles.

12. The bag of claim 11, wherein the plurality of baffles form a plurality of pockets for trapping liquid particles.

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13. The bag of claim 8, wherein the plurality of baffles comprise a U-shape.

14. The bag of claim 13, wherein the plurality of baffles include a slit in a trough of the U-shape, the slit being sized such that gas can pass through the slit.

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15. A bag adapted to receive a particle, comprising:

a first panel;

a filterable permeable layer; and



- a first inner layer laminated to the first gas-impermeable layer, the first inner layer having a textured exposed surface;
- wherein the textured exposed surface obstructs liquid flow when gas is evacuated through the heat-sealable opening; and
- 5           a second panel including:
  - a second gas-impermeable layer; and
  - a second inner layer laminated to the second gas-impermeable layer; wherein the second inner layer is connected with the second panel to form an envelope such that the first inner layer opposes the second inner layer, the envelope including a heat-sealable opening for evacuating gas.
- 10           16. A heat-sealable bag configured to receive an article, comprising:
  - a first panel including:
    - a first gas-impermeable layer;
    - at least one first intermediate layer connected with the first gas-impermeable layer; and
    - a first inner layer laminated to the at least one first intermediate layer, the first inner layer having a textured exposed surface;
      - wherein the textured exposed surface obstructs liquid flow when gas is evacuated through the heat-sealable opening; and
  - a second panel including:
    - a second gas-impermeable layer;
    - at least one second intermediate layer connected with the second gas-impermeable layer; and
    - a second inner layer laminated to the at least one second intermediate layer;
- 25           wherein the first inner layer is connected with the second panel to form an

envelope such that the fit

including a heat-sealable op

and opposes the second inner layer, the envelope  
of circulating gas.

17. The bag of claim 1  
5 impermeable layer comprising

the first gas-impermeable layer and the second gas-impermeable layer, polyamide, ethylene vinyl alcohol, and nylon.

18. The bag of claim 10,  
a thermoplastic resin.

the first inner layer and the second inner layer comprise

10

19. The bag of claim 1

the thermoplastic resin is polyethylene.

20. The bag of claim 10,  
channels.

the textured exposed surface comprises a plurality of

15

21. The bag of claim 1

plurality of baffles.

the textured exposed surface further comprises a

22. The bag of claim 20  
pattern.

In the plurality of baffles are arranged in a herringbone

23. The bag of claim 21, trapping liquid particles.

in the plurality of baffles form a plurality of pockets for

25      24.      The bag of claim 1

         baffles.

n) textured exposed surface comprises a plurality of

25. The bag of claim 24, wherein the plurality of baffles form a plurality of pockets for trapping liquid particles.

26. The bag of claim 24, wherein the plurality of baffles comprise a U-shape.

5

27. The bag of claim 24, wherein the plurality of baffles includes a slit in a trough of the U-shape, the slit being sized such that a particle can pass through the slit.

28. A bag adapted to receive a particle, comprising:

10

a first panel comprising a plurality of receptacles adapted to trap a liquid and a plurality of channels that pass through the receptacles, which channels are adapted to allow the passage of a gas;

a second panel adapted to be secured to the first panel, the second panel secured together to form the bag.

15

29. A bag adapted to receive a particle, comprising:

a first panel comprising a plurality of receptacles adapted to trap a liquid, which receptacles are formed with a first wall that runs about along a length of the bag and a plurality of second walls that extend across the length of the bag in a direction that is across the length of the bag;

20

a second panel adapted to be secured to the first panel, the second panel secured together to form the bag.

30. A system for forming a three-dimensional structure formed on at least one panel, comprising:

25

a cooling region adapted to form a plurality of cavities for forming one or more structures; wherein the structures include a plurality of receptacles adapted

to trap a liquid;

- a laminating  
 a backing material;  
 a flowable resin; and  
 the one or more structures, wherein the resin can be flowed into the one or more cavities to form a material adhering to the backing material.
- 5
31. A method for forming a structure in a sealable bag, comprising:  
 flowing a resin between a backing film, such that the flowing material is  
 molded to form a structure;  
 wherein the structure includes a plurality of protuberances;  
 cooling the structure such that the flowing material solidifies to form  
 10 an inner layer having the structure;  
 wherein the structure adheres to the backing film.
32. A method for forming a structure in a bag adapted to receive an article, the bag being partially  
 15 formed between a laminating roll and a cooling roll having a plurality of cavities for forming  
 a structure, comprising:  
 feeding a gas-impermeable film to a nip formed by the cooling roll and the  
 laminating roll;  
 extruding resin between the cooling roll and the laminating roll, so that the resin fills the nip and the plurality of cavities  
 20 exposed to the nip;  
 pressing the film between the cooling roll and the laminating roll;  
 cooling the structure such that the resin forms the structure and adheres to the  
 gas-impermeable film, forming a structure;  
 wherein the structure comprises a plurality of protuberances;  
 25 folding the structure such that a first portion of the panel overlaps a second  
 portion of the panel; and  
 applying heat to the first, second, and third side of the first and second portions

9

such that an envelope is formed

33. A method for manufacturing a first gas-impermeable film, comprising:  
 feeding a first gas-impermeable film to a first nip between a first cooling roll and a first laminating roll, the first laminating roll having a plurality of cavities for forming a structure;

extruding molten resin between the first cooling roll and the first gas-impermeable film such that a first inner layer is formed; and  
 10 nip;

cooling the resin between the first cooling roll and the first gas-impermeable film, forming a first inner layer wherein the first inner layer comprises a plurality of protuberances;  
 feeding a second gas-impermeable film to a second nip between a second cooling roll and a second laminating roll, the second laminating roll having a plurality of cavities for forming a structure;  
 15 extruding molten resin between the second cooling roll and the second gas-impermeable film, forming a second inner layer wherein the second inner layer comprises a plurality of protuberances;  
 pressing the second inner layer against the first inner layer, thereby forming a second panel overlapping the first panel;  
 20 applying heat to the first and second panels such that the first panel and the second panel form an envelope.

25

34. A method for manufacturing a second gas-impermeable film, comprising:  
 rotating a first cooling roll at a first rate, the first cooling roll including one or

more cavities adapted to receive an article, comprising:

feeding a first gas-impermeable film to a first nip between a first cooling roll and a first laminating roll, the first laminating roll having a plurality of cavities for forming a structure;

extruding molten resin between the first nip;

cooling the resin between the first cooling roll and the first gas-impermeable film such that a first inner layer is formed; and

pressing the first inner layer against the first gas-impermeable film, thereby forming a first panel wherein the resin forms the structure and adheres to the first gas-impermeable film;

feeding a second gas-impermeable film to a second nip between a second cooling roll and a second laminating roll, the second laminating roll having a plurality of cavities for forming a structure;

extruding molten resin between the second nip;

cooling the resin between the second nip;

pressing the second inner layer against the second gas-impermeable film, thereby forming a second panel overlapping the first panel;

applying heat to the first and second panels such that a second inner layer is formed;

pressing the second inner layer against the second gas-impermeable film, thereby forming a second panel overlapping the first panel;

applying heat to the first and second panels such that the first panel and the second panel form an envelope;

applying heat to the first and second panels such that the first panel and the second panel form an envelope;

applying heat to the first and second panels such that the first panel and the second panel form an envelope.

35. A method for manufacturing a second gas-impermeable film, comprising:

rotating a first cooling roll at a first rate, the first cooling roll including one or

both of a plurality of cavities  
a plurality of channels defined  
rotating a first cooling roll  
introducing a first gas-impermeable film having at least one layer to a first nip  
5 between the first cooling roll and the first gas-impermeable film;  
extruding a first gas-impermeable film having at least one layer to a first nip;  
pressing the first gas-impermeable film such that it fills the plurality of cavities exposed to the first nip;  
10 cooling the first gas-impermeable film such that a first inner layer is formed;  
wherein the first inner layer comprises the structure;  
wherein the first inner layer adheres to the first gas-impermeable film, thereby forming a first panel;  
rotating a second cooling roll  
15 rotating a second gas-impermeable film having at least one layer to a second nip between the second cooling roll and the second gas-impermeable film;  
extruding a second gas-impermeable film having at least one layer to a second nip;  
pressing the second gas-impermeable film such that a second inner layer is formed;  
20 gas-impermeable film;  
cooling the second gas-impermeable film such that a second inner layer is formed;  
wherein the second inner layer adheres to the second gas-impermeable film, thereby forming a second panel;  
overlapping the first panel with the second panel; and  
25 applying heat to a periphery of the first and second panels such that an envelope is formed.

of protuberances for forming a structure having a plurality of cavities defined by a plurality of baffles;  
roll at a second rate;  
permeable film having at least one layer to a first nip  
laminating roll;  
the first nip;  
between the first cooling roll and the first gas-impermeable film;  
in fills the plurality of cavities exposed to the first nip;  
such that a first inner layer is formed;  
er comprises the structure;  
adheres to the first gas-impermeable film, thereby forming a first panel;  
roll at a third rate;  
ng roll at a fourth rate;  
impermeable film having at least one layer to a second nip between the second cooling roll and the second gas-impermeable film;  
the second nip;  
between the second cooling roll and the second gas-impermeable film;  
uch that a second inner layer is formed;  
ayer adheres to the second gas-impermeable film, thereby forming a second panel;  
d with the second panel; and  
f a periphery of the first and second panels such that an envelope is formed.

1

35. The method of claim 34, wherein the second rate is an integer multiple of the first rate and the fourth rate is an integer multiple of the third rate.

36. The method of claim 35, wherein the first gas-impermeable film and the second gas-impermeable film comprise a single layer.

37. The method of claim 36, wherein the at least one layer is one of polyester, polyamide, ethylene vinyl alcohol, and polypropylene.

38. The method of claim 37, wherein the molten resin is polyethylene.

39. The method of claim 38, wherein the thickness of the first inner layer is determined by the size of the first nip and the thickness of the second inner layer is determined by the size of the second nip.

40. The method of claim 39, wherein the plurality of protuberances are a plurality of baffles.

41. The method of claim 40, wherein the plurality of protuberances are a plurality of vessels.

42. The method of claim 41, wherein the plurality of protuberances are a plurality of catches.

43. A method of manufacturing a container adapted to receive an article, comprising:  
rotating a film to define a plurality of recesses that can define a plurality of receptacles;

rotating a se  
a first film adjacent to the first  
applying a n  
said molten  
5 material and film moving be  
with a plurality of receptacles  
forming a se  
mating the f

10 44. The method of claim  
using a gas  
using a heat

15 45. The method of claim  
of baffles.

46. The method of claim  
of vessels.

20 47. The method of claim  
of catches.

48. The method of claim  
the second roller.

25

49. The method of claim  
the second roller, and the m

acent to the first roller, said second roller can feed  
between the first roller and the film;  
the recesses of the first roller, and said molten  
roller and the second roller forming a first panel  
and  
a second panel in order to form a bag.

material for the film; and  
material for the molten material.

forming the plurality of receptacles forms a plurality

forming the plurality of receptacles forms a plurality

forming the plurality of receptacles forms a plurality

said second panel is formed with the first roller and

said second panel is formed with the first roller and  
des folding the first panel over the second panel.



50. The method of claim 49, wherein the first portion includes the plurality of recesses and the second portion without a plurality of recesses.

5 51. The method of claim 50, wherein the first portion that can be filled with the molten material.

52. The method of claim 50, wherein the first portion parallel to the length of the film.

10 53. The method of claim 50, wherein the first portion formed from the plurality of recesses with some of the plurality of recesses and some of the plurality of recesses run parallel to the length of the film.

15 54. The method of claim 50, wherein the first portion formed from the plurality of recesses with some of the plurality of recesses and some of the plurality of recesses run perpendicular to the length of the film.

20 55. The method of claim 50, wherein the first portion formed from the plurality of recesses with some of the plurality of recesses and some of the plurality of recesses run across the direction of rotation of the first roller.

56. The method of claim 50, wherein the first portion formed from the plurality of recesses with some of the plurality of recesses and some of the plurality of recesses run parallel to the length of the film.

25 57. The method of claim 50, wherein the first portion formed from the plurality of recesses with some of the plurality of recesses and some of the plurality of recesses run perpendicular to the length of the film.

58. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles and a plurality of recesses.

59. The method of claim 50, wherein the first roller includes another plurality of recesses for defining a plurality of channels that run the length of the film.

60. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles in part with walls that run parallel to the length of the film and some of the walls that run across the length of the film.

61. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles from the plurality of recesses with some of the plurality of recesses running parallel to the length of the film and some of the plurality of recesses running perpendicular to the length of the film.

62. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles from the plurality of recesses with some of the plurality of recesses running in about the direction of rotation of the first roller and some of the plurality of recesses running in about a direction perpendicular to the peripheral surface.

63. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles forms U shaped receptacles.

64. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles forms V shaped receptacles.

65. The method of claim 50, wherein the first roller includes a peripheral surface having a plurality of recesses for defining a plurality of receptacles forms L shaped receptacles.

1

58. The method of claim  
of liquid trapping shapes.

forming the plurality of receptacles forms a plurality

59. The method of claim  
such that gas flows through.

a passage is formed the plurality of receptacles

5

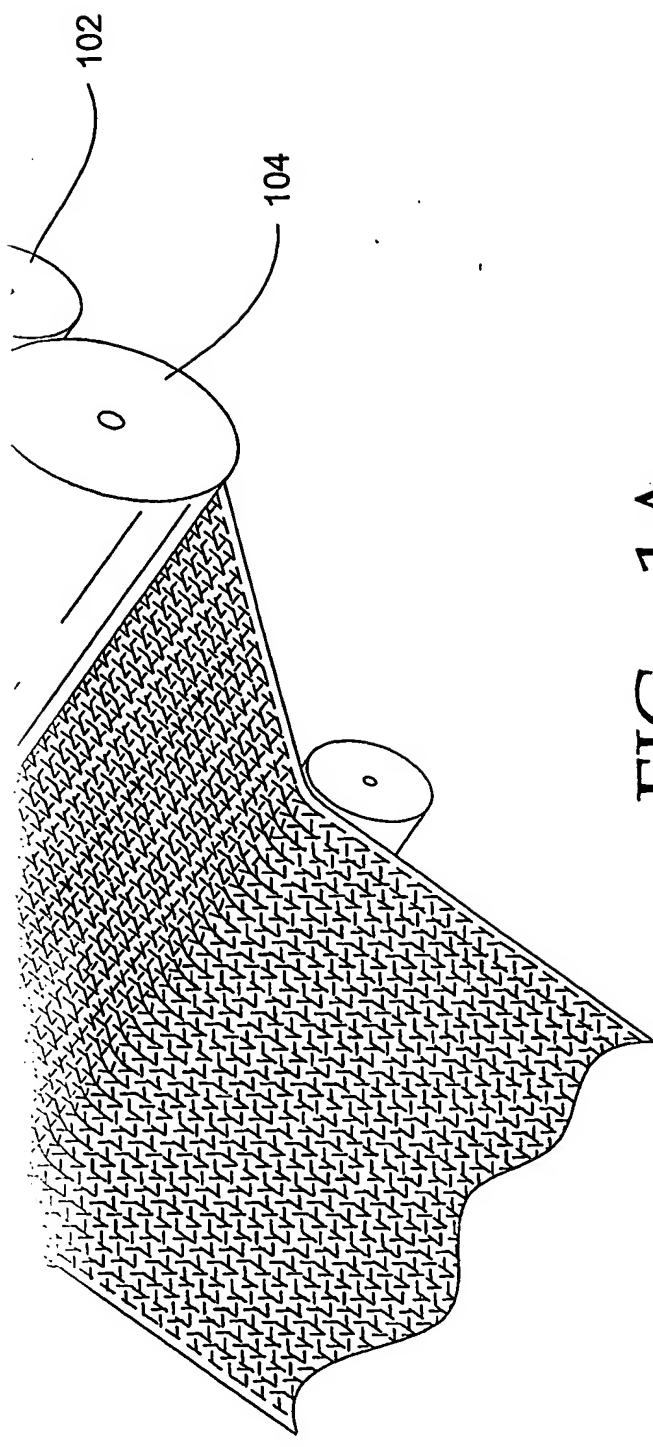
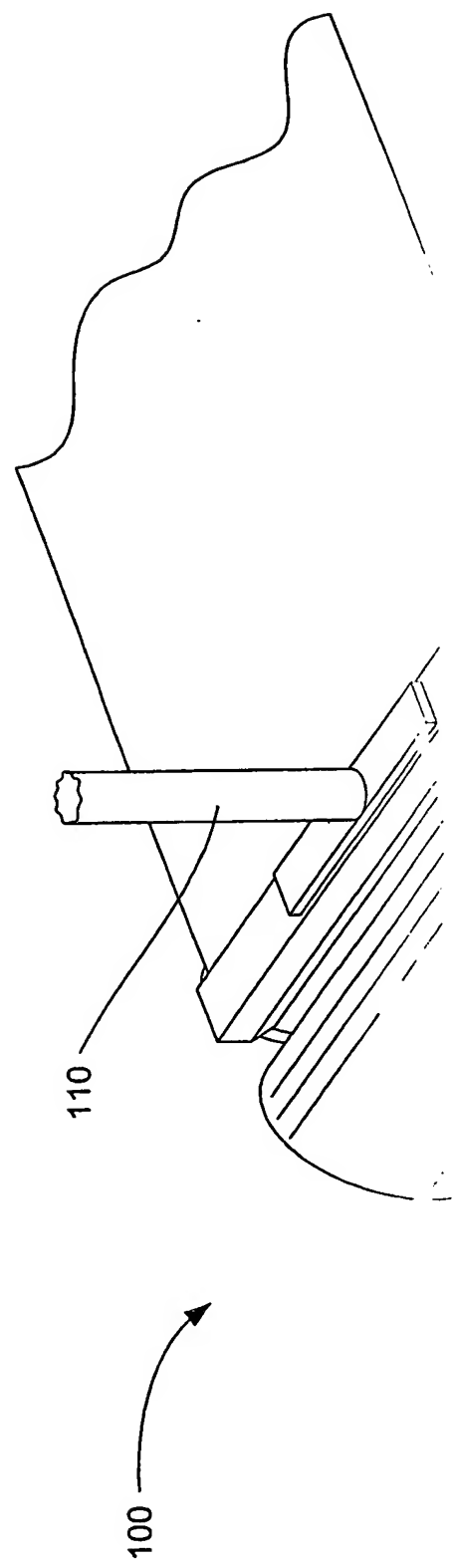
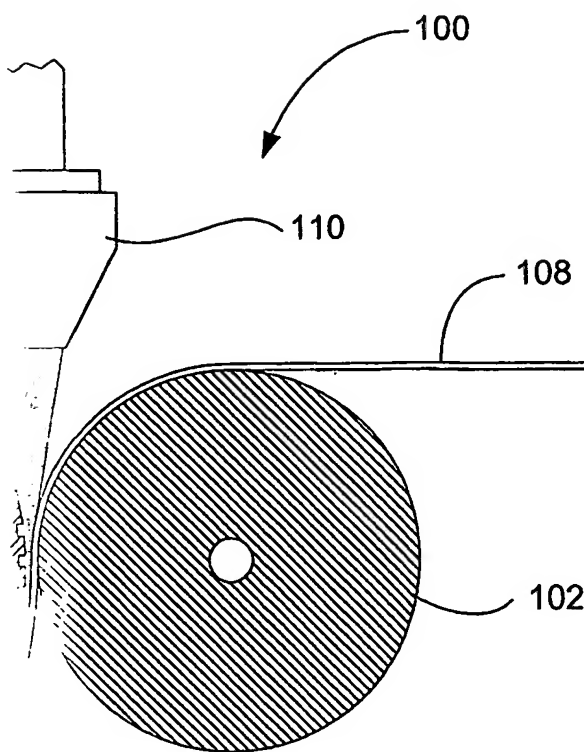
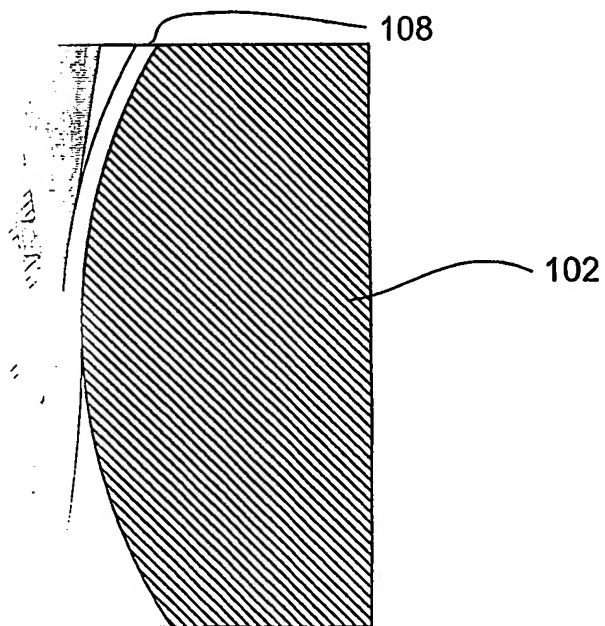


FIG. - 1A

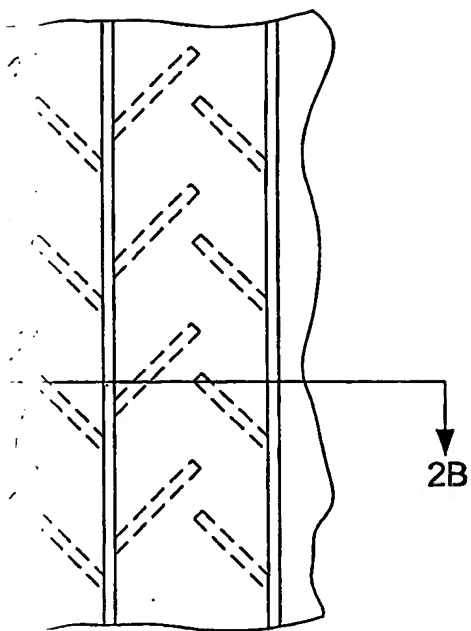
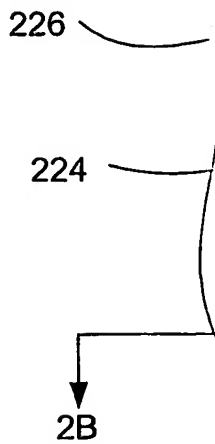


- 1B

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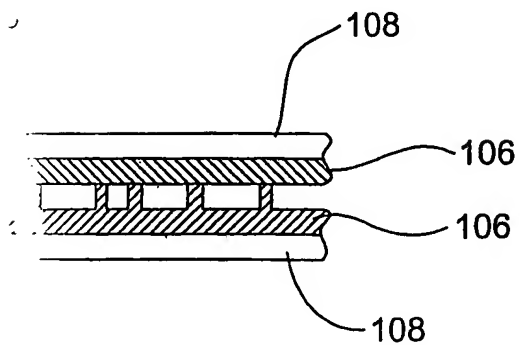


- 1C



2A

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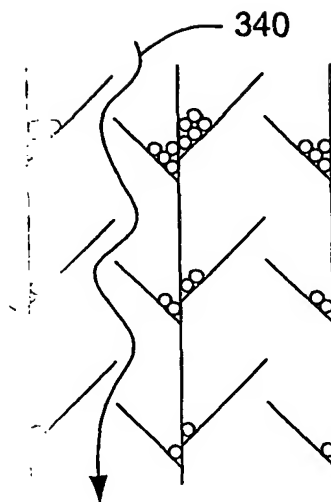


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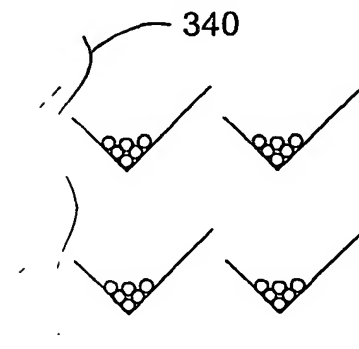


3A

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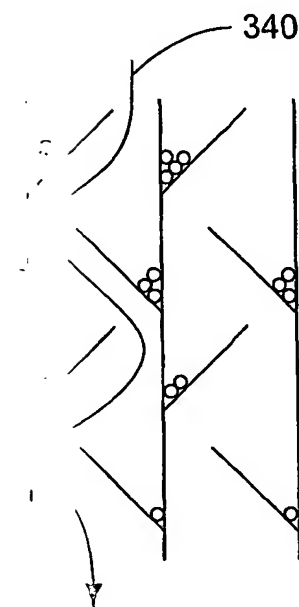


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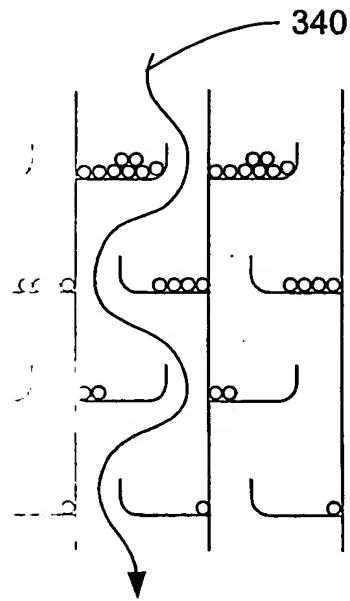
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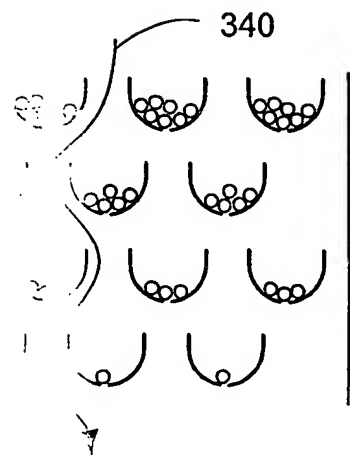


- 3D

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- 3E

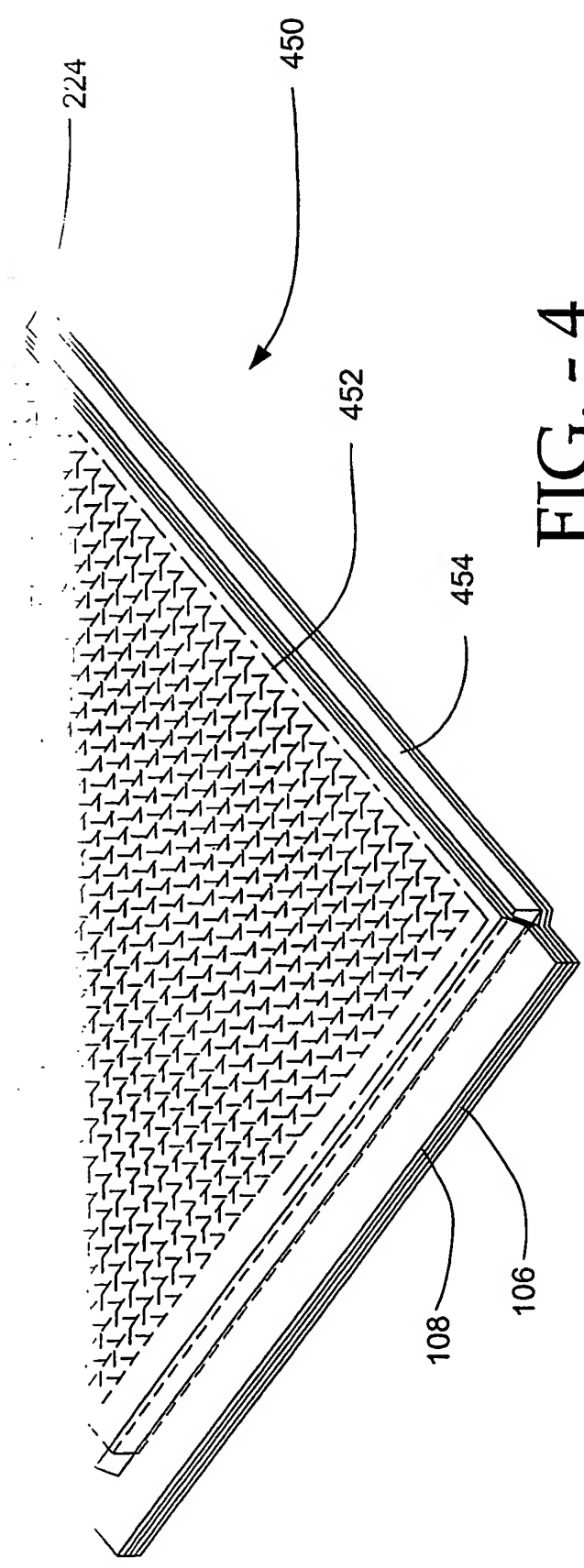
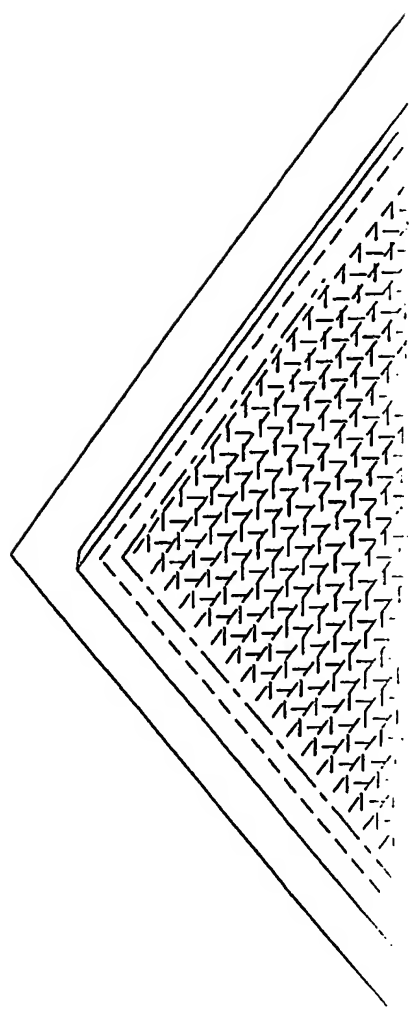


FIG. - 4



# INTERNATIONAL

International application No.

PCT/US04/06769

**A. CLASSIFICATION OF SUBJECT**  
 IPC( ) : B65D 33/00  
 US CL : 428/35.7, 36.6, 36.7, 346  
 According to International Patent Classification

## B. FIELDS SEARCHED

Minimum documentation searched (classified)  
 U.S. : 428/35.7, 36.6, 36.7, 346

Documentation searched other than minimum  
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Electronic data base consulted during the int  
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## C. DOCUMENTS CONSIDERED TO

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X	US 2,778,173A (TAUNTON
---	9B, 15 and 18.
Y	
Y	US 5,554,423A (ABATE) 10
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ase and, where practicable, search terms used)

of the relevant passages	Relevant to claim No.
col. 1, lines 16-22, Figures 3-	1 and 28
	1-13, 15-26, and 28-59
col. 1, lines 62-67 and col. 2,	1-13, 15-26 and 28-59
2,1998), title and abstract.	31-59

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